Variability abounds in speech, and listeners must cope with this variability in order to understand spoken language. Foreign accents can be particularly detrimental to spoken language processing, resulting in slower processing and less accurate identification of spoken words. Research suggests that listeners can adapt to the acoustic-phonetic properties of the speech they encounter (e.g., adapting to patterns of pronunciation variation due to a talker’s accent or idiolect; Bradlow & Bent, 2008; Norris, McQueen, Cutler, 2003). Here we investigate whether short-term exposure to accented speech facilitates subsequent processing speed and accuracy of the same talker (talker-dependent accent adaptation) or even different talkers of the same accent (talker-independent accent adaptation). A secondary aim of our experiment was to assess the viability of using crowdsourcing to study accent adaptation over the web. Online experimental paradigms are becoming increasingly popular in the psychological and social sciences, in part because crowdsourcing simultaneously facilitates recruitment of a large number of participants with the desired characteristics (e.g., a specific language background, Fraundorf & Jaeger, 2014), while also significantly reducing costs and the time and effort required for recruitment.

**Method:** We implemented Clarke and Garrett’s 2004 between-subjects exposure-test adaptation paradigm online using Amazon’s MechanicalTurk. The entire experiment lasted about 2 minutes. Participants (N = 139 of 168 targeted) heard low predictability sentences, in which the final word is not predictable from the preceding context (e.g., *He looked at her wrist*), followed at sentence offset by a visually-presented probe word (e.g., FIST). Participants judged as quickly and accurately as possible (using their computer keyboard) whether the visual probe matched the last word of the spoken sentence (half the trials did; the other half involved a mismatching visual probe: *wrist*-FIST). We measured response times to assess perceptual processing speed of the spoken sentences.

**Design (see Fig 1):** The experiment consisted of 3 exposure blocks (manipulated across participant groups), followed by 1 test and 1 baseline block (both identical across participant groups). All blocks consisted of six trials. Exposure manipulated whether participants heard unaccented English (control) or moderate Mandarin-accented English. In the same-talker accented condition, the exposure and test talker were identical; in the different-talker accented condition, they were not. Exposure talkers produced the same sentences across all conditions and sound file durations were normalized across speakers (to avoid confounding RTs across conditions, following Clarke and Garrett, 2004). The test phase was 6 new sentences produced by the same Mandarin-accented speaker. In the baseline block, all participants heard 6 new sentences produced by the same native speaker. This block was used to adjust RTs in all other blocks for participant-specific processing speed (see Fig 2).

**Predictions.** We had five predictions for response times: (P1) RTs are initially slower in the accented conditions than in the control condition due to the initial difficulty of
processing foreign-accented speech; (P2) RTs decrease over the course of the exposure phase, independent of exposure condition (i.e., task adaptation); (P3) the RT decrease during exposure is larger in the accent conditions than in the control condition (i.e., accent adaptation above and beyond task adaptation); (P4) RTs for the same-talker accented condition during the test block are faster than the control condition because control participants are hearing accented speech for the first time; and (P5) RTs for the different-talker accented condition during the test block are faster than the control condition, but slower than the same-talker condition—i.e., rapid adaptation is in part talker-dependent but also includes talker-independent adaptation. We expected the inverse (or no) pattern in the error rates.

**Response Time results:** Response times were first adjusted to account for individual variability in response speed: RTs from the final block (baseline) were subtracted from experimental RTs. Adjusted RTs for correct responses were then analyzed with linear mixed effect regression (Baayen et al., 2008). To analyze the change in RTs during exposure, the exposure phase was split into three blocks of six trials. Results confirm all four of our predictions for RTs (Figure 2a). Participants listening to Mandarin-accented English were initially much slower than participants listening to native English speech (mean difference: 178ms, p<.05), regardless of the specific accented talker. RTs decreased over the course of the exposure phase (from Block 1 to 3), independent of exposure condition (p<.05). Critically, the RT decrease during exposure was significantly larger in the accent condition (p<.05), and by the end of exposure, RTs in the accent and control condition were comparable (difference in Block 3 = 27ms, p>.8). At test, control participants were significantly slower than participants in the same-talker accented condition (192ms, p<.05). The different-talker accented condition numerically fell between the control and same-talker accented condition.

**Error rates:** Errors were analyzed using mixed logit regression. Results confirmed our predictions (Fig. 2b). There were overall more errors in the accent condition (p<.05). There was a significant decrease in errors from Block 1 to 4 in the accented conditions (p<.05), as expected due to accent adaptation. Despite this decrease, however, error rates for accented speech were still higher than for native speech. Finally, as expected, errors at test were higher in the control than in the accent condition (p<.05).

**Conclusion:** Accented speech is initially processed more slowly than native speech. Listeners can rapidly overcome much of this difficulty within two minutes (18 sentences). However, contrary to a frequent interpretation of Clarke and Garrett (2004), this adaptation does not lead to completely native-like processing within two minutes. Once both speed and accuracy are considered, it is clear that the processing of accented speech is still impaired (though improved) after 2 minutes of exposure, compared to native speech. Additionally, some of the adaptation observed is not talker-independent accent adaptation, but rather adaptation to the specific talker.

![Figure 2a: Average difference reaction times for the same-talker accented and control (native) conditions in each exposure and test block. Figure 2b: Proportion of errors for the same-talker accented and control (native) conditions in each exposure and test block.](image-url)